

**Reconsidering patients with chronic kidney psychological needs:
optimizing hemodialysis room design**

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Abstract

Chronic kidney failure (CKF) and its treatment often manifest in anxiety and fear in patients. The present study aimed to gain an in-depth understanding of how hospital interior design, hemodialysis rooms, in particular, can exacerbate or alleviate anxiety and fear in patients with CKF. Specifically, it reviews relevant literature to unveil to what extent a home-like environment in CKF healthcare centers might minimize anxiety and fear compared to an institutional design. Findings revealed patients with CKF delineate into three groups based on their psychological response to their disease and their ability to adapt to the new situation. Based on these classifications, the researcher proposed three models for the dialysis room to reduce anxiety and fear in each category. Crucially, while a homey environment in healthcare centers helps to mitigate anxiety and fear in a subset of patients with CKF, other patients may feel more anxious and fearful in such an environment.

Keywords: Home-Like Environment Design Approach, Institutional Environment Design Approach, Designing Hemodialysis Rooms, Anxiety, And Fear

Introduction

Chronic kidney failure (CKF), or kidney failure, causes severe psychological and physical patient suffering, primarily because of the arduous renal dialysis routine two to four times a week (Hawamdeh, *et al.* 2017; Senanayak, *et al.* 2018). Several researchers have unveiled a comfortable,

pleasant, and relaxing environment alleviated patients' suffering. (Baker & Lamb, 1992; Ulrich, 1991). Ulrich (1991) reported hospital settings and design features contribute positively to patient outcomes. Researchers and designers have increased interest in healthcare centers' home-like environments mitigating psychological problems resulting from physical diseases. On the other hand, other researchers have highlighted institutional over the home-like settings. This research aims to emphasize when and in what cases these two designs effectively alleviate patient CKF anxiety and fear.

Research problem

The research problem represents the following central questions: How can the built environment alleviate anxiety and fear resulting from CKF treatment? Does the home-like or institutional environment more effectively mitigate patients with CKF anxiety and fear?

Research Objectives

The fourfold purpose study aims to gain an in-depth understanding of how the interior design of hospitals, specifically hemodialysis rooms, can exacerbate or alleviate anxiety and fear in patients with CKF. It also investigates to what extent a home-like environment in CKF healthcare center's design might assuage anxiety and fear compared to an institutional structure and identify design features impacting patients in hemodialysis positively while recommending future research.

Methodology

The researcher will follow a three-fold methodology. Firstly it will review relevant literature addressing CKF's psychological effects, the healing environment, and healthcare center design affecting patients' with CKF psychological health. Secondly, it compares the effectiveness of the home-like with the institutional setting in relieving kidney patients' anxiety and fear. Thirdly, it will formulate three models to alleviate fear and anxiety among patients with renal failure based on previous experts' classifications of patients with renal failure.

Kidney Failure

Chronic kidney failure embodies a progressive and irreversible deterioration of renal function. The body cannot dispose of metabolic residues or maintain normal water, acid, and chemical balances. As urea and blood nitrogen concentrations increase, these levels reach toxicity (Romagnani, *et al.* 2017).

Kidney Dialysis

Kidney dialysis, or hemodialysis, engenders a medical procedure purifying the body of excess fluids and toxins resulting from metabolism in the presence of impaired kidney function. The procedure takes two to four hours per treatment, depending on the degree of renal failure (Hamed, 2019).

Psychological effects of kidney failure

Many diseases negatively affect patients psychologically, promoting anxiety, isolation, and depression. Many researchers have demonstrated psychological symptoms are most severe in seriously ill patients (Chochinov, *et al.* 1995; Gerogianni, 2003; Kaasa, *et al.* 1993). Patients with CKF are exposed to long-term adverse psychological impacts of lifelong dialysis (Hernandez, *et al.* 2018). Hemodialysis presents a time-consuming treatment, where patients must attend dialysis centers three to four times per week (Yong, *et al.* 2009). Adapting to the disease limitations and intensive treatment can impose a lengthy challenge for patients with CKF. They can find it difficult to adapt their jobs and social life to the new lifestyle and dietary restrictions (Gerogianni, 2003). Unsurprisingly, patients with CKF have increased vulnerability to several psychiatric problems, including anxiety, depression, low self-esteem, difficulties sleeping, feelings of aggression, and hopelessness (Gerogianni & Babatsikou, 2014; Hweidi, 2007). Depression makes some patients elect to stop treatment because they perceive their lives are not worth living. They may also experience fear and anxiety stemming from medical intervention mistrust or the prospect of disability or death (Gerogianni & Babatsikou, 2014). Koutsopoulou, *et al.* (2009) found Patients with CKF participating in dialysis regularly developed various personality disorders depending on gender and age.

Specifically, before enrolling in a CKF program, these patients faced a health condition similar to people with chronic issues. They experienced significant psychiatric personality disorders, such as Alzheimer's disease, after starting dialysis.

Attitudes of ckf patients towards dialysis treatment

In a study exploring the relationship between stress, coping strategies, and medical outcomes in patients with psoriasis, four patient coping strategies emerged (Fortune, *et al.* 2002):

- *Problem-focused coping*: resolving problems to eliminate anxiety.
- *Avoidance coping*: denying problems underlying anxiety to avoid confronting negative emotions or thoughts.
- *Emotion-focused coping*: reducing negative feelings rather than solving the root cause(s) of those feelings.

Distancing/reappraisal: accepting lack of control over their disease, situational reality, and coming to terms with a new normal.

The distancing/reappraisal coping strategy was associated with lowered patient anxiety, while avoidance and emotional coping were associated with high anxiety. Theofilou (2010) identified three stages patients pass through as they adapt to dialysis. The first honeymoon stage typically begins one to three weeks after their first hemodialysis. In this phase, patients with acute kidney failure accept their dialysis, as well as their reliance on physicians and the artificial kidney system, with relative ease. On the other hand, patients with progressive CKF are more likely to experience fear and anxiety about the prospect of their disability and death during this stage. They also generally feel anxious about the disease adversely affecting finances, work, and social lives. Patients subsequently enter disappointment, usually lasting three to 12 months, where they feel intense sorrow and depression, and disappointment and frustration manifest in fatigue. Patients in this stage often feel anger and hostility towards family and unit staff. The final long-term adjustment phase emerges as patients gradually recognize dialysis limitations, alternating between periods of satisfaction and depression.

In a study examining interactions between patients with CKF and life-saving medical devices, Impellicceiri (2005) asserted patient personality critically shaped the treatment attitudes formed, classifying patients into two primary categories.

The first of these were denoted passengers. These were patients with greater confidence in medical staff and were reassured the staff was in charge of their treatment. These patients preferred to have their dialysis treatments performed in a clinic.

In contrast, patients denoted as drivers had a significantly greater need to control their dialysis equipment and care. They felt more comfortable and in control when trained and equipped to perform their treatments at home. Some patients, however, were not classified as either passengers or drivers. Such patients often stopped their treatment altogether, categorized as deniers. According to estimates, 20-30% of deaths among patients with CKF occur due to discontinuation, refusal to resume, or unwillingness to provide dialysis due to local circumstances (Casrto, 2019; Cukor, *et al.* 2007; Tijerina, 2006).

Healing environment and design procedures for mitigating patients' with ckf anxiety and fear

In the last three decades, the healing environment concept has received significant interest from researchers and architects aiming to design healthcare centers to speed up healing and mitigate the negative psychological disease impacts. Most causes of patient stress in the hospital entail crowding, noise, lack of privacy, and lack of control (Shumaker & Pequegnat, 1989; Ulrich, 1991). Researchers have claimed hospital settings and design could contribute positively to patient outcomes. Physical design, such as calming colors, pleasant sounds, natural views, daylight, and artwork, improve patient moods and accelerate recovery (Murphy, 2000; Stichler, 2001).

Despite differences in the definition of what constitutes a healing environment constitutes any setting enhancing and promoting the healing (Abbas & Ghazali, 2011).

Improving healthcare center design to meet the healing requirements has drawn heavily on evidence-based design (EBD), rooted in complementary medicine and holistic healing. This new fundamental design framework uses the latest scientific evidence to guide rational decisions about the built environment to achieve the best health outcomes (Hamilton, 2003; The Centre for Health Design, 2012; Ulrich *et al.*, 2004).

Creating healing environment in health care centers - institutional environment versus home-like environment

Experts have recognized healthcare centers with home-like environments accelerate recovery. On the other hand, other researchers have highlighted institutional setting advantages, claiming sharing rooms and viewing medical equipment foster patients' psychological safety. The following research will detail this point.

Home-like environment design approach

Many researchers have recommended a home-like design to promote healing. McLoughlin and Gonzalez (2014) professed the enriching home environment supports patients, promoting inclusion that does not isolate patients from the broader community. A hominess also helps healthcare facilities offer a welcoming, pleasant, and familiar atmosphere. Jencks (1995) advocated a hospital design should mimic a home oasis, a warm and attractive place where patients can relax, meet friends and participate in rewarding activities.

Institutional design approach

The institutionalized hospital design emerged around the 20th century in response to the hospital as a working unit or healing mechanism dominating architectural thought. Indeed, Hudent (1947, as cited in Dijkstra, 2009 purported hospitals following this design trend depict "a product of the technologies of medicine and manufacture, so precisely adapted to the uses of science, as to become in effect a scientific instrument not essentially different from the X-ray machine or the operating table which it encloses" (p. 11).

In critiquing this trend, Mahnke (1996) recommended the therapeutic hospital functions should not be highlighted in its design, "otherwise the impression of a 'hospital factory' is quickly reflected" (Mahnke, 1996, p. 147, as cited in Dijkstra, 2009, p. 11). Such trends can induce or accentuate fear, anxiety, stress, and uncertainty. As such, the institutional environment has been widely described as a non-humanistic environment. Bates (2018) advanced three core humanistic design principles applying to hospitals:

- The human is not constitutional; design must respect the scale of human life as it exists in the home and the village.
- The human is not technology; technology should be hidden, emphasizing natural views.
- The human is not biomedical; design must respect patients' emotional and holistic needs.

Comparing the psychological impact of the two design approaches on patients with CKF

Mogensen (2011, p.42) defined the function, finishing materials and texture, and details and accessories as three critical components differentiating homey from the institutional environments in hospitals. Accordingly, the researcher will compare each element's influence on anxiety and fear in a home-like and institutional setting.

Function

According to environmental psychologists, function is associated with design, creating privacy, sociability, psychological safety, and order.

Privacy

Privacy exemplifies a defining attribute of a homey environment. However, while many experts have contended staying in a single-patient room can alleviate patient stress and reduce infection incidence (Firestone, Lichtman, & Evans, 1980), patients' preferences for staying in single-patient versus shared rooms vary according to disease. The more severe the disease, the less privacy they demand. For example, an oncology patient

survey revealed these patients preferred multi-bed rooms over single bedrooms, with most favoring four-bed bays (Pease & Finlay, 2002). Lawson and Phiri (2003) also investigated patients' preference for single versus multi-bed rooms among 473 patients at Poole General Hospital in the United Kingdom. They unmasked 54% of patients preferred shared rooms, while 43% preferred a single room. Solidarity with other patients can take many forms, from intense conversations and mutual support to stimuli and inspiration from other patients' activities and behaviors (Johnsen, *et al.* 2005 cited in Mogensen, 2011, p.42). The researchers attributed these results to patients' desire for companionship to avoid isolation and loneliness. However, the need for privacy and sociability must remain balanced. When people feel their privacy is violated, they may prefer social withdrawal to social interaction (Williams, 2005). On the other hand, social interaction opportunities decrease when patients encounter the high privacy single room affords.

Sociability

Several designs encourage patient-to-patient interaction to alleviate psychological symptoms. For example, Duel (2018) reported patient-to-patient interactions allowed patients to share coping strategies to reduce anxiety and fear. Interactions also decreased despair, increased hopefulness, and enhanced the patient's ability to manage one's disease. Other researchers have demonstrated interacting with others who share the same illness provides patients psychological support, increasing hopefulness (Bastian, *et al.* 2014). Therefore, facilitating patient-to-patient interaction through interior design should promote hopefulness among patients. Furthermore, scholars have suggested shared pain produces solidarity and cooperation among people who share the same painful experience. Bastian, *et al.* (2014) demonstrated psychological bonding and collaboration between patients. Therefore, patients with CKF may find solace and comfort when interacting with patients who share the same suffering. Given dialysis can cause despair and anxiety for patients, increasing opportunities for social interaction through architectural design could help patients undergoing dialysis gain valuable psychological and social support, minimizing

fear and anxiety. For this reason, shared rooms may be more desirable for patients with CKF than single rooms.

Psychological Safety

Safety means feeling or knowing one is protected against danger. Technological medical devices, considered a significant attribute of the institutional environment, may convey positive messages for patients, reassuring them they are being treated in a hospital with high-quality care. For example, Johansson, *et al.*(2012) conducted a study in intensive care units, evaluating the impact of device sounds on patient stress. They contended audible device sounds positively affected stress when patients were informed of sound origination and the medical represented function(s) (Johansson, *et al.* 2012). While hiding medical equipment generates a homey environment, these researchers uncovered such devices helped patients feel in control and conscious of what was happening around them. Therefore, concealing medical equipment to foster a homey environment does not necessarily benefit mental health. Another institutional environment feature promoting psychological safety entails patients seeing nursing and doctor's staff moving up and down corridors, which has been shown to increase feelings of safety (Vos, 2004, as cited in van Nijhuis, 2017). Patients residing in single rooms, emulating a home environment, cannot observe medical staff activities.

Order

Standardization reflects an institutional design feature most contradicting the homely environment. For instance, when a facility has identical rooms, the nursing staff encounter the same distribution, layout, and lighting in every room, expediting their work. Accordingly, standardization of patient rooms and equipment makes routine tasks simpler and decreases staff errors (Huisman, Morales, Hoof & Kort, 2012).

Finishing Materials and Texture

Hospital finishing materials are usually selected based on cleanliness, sterilization, maintenance ease, and durability (Huisman, *et al.* 2012). Though wood surfaces and flooring promote hominess and warm interior

surroundings, some restrictions dissuade wood in healthcare institutions. For example, wood and fabric furniture do not meet infection hospital prevention requirements. According to Malone and Dellinger (2011), furniture surfaces used in healthcare institutions must be:

- Easy to maintain, repair, and clean
- Mitigative of microbial growth
- Nonporous and smooth
- Seamless

Smooth and polished surfaces prevent bacterial and germ growth and are less likely to attract dust. They are also easy to clean and give a sense of general cleanliness and order. On the other hand, excessively smooth and polished surfaces may create a cold setting discouraging social interaction, whereas wood may generate warmth and enhance patients' with CKF psychological safety.

Details and Accessory

Flooring

Scholars have revealed carpeted rooms instead of bare or vinyl floors foster psychological comfort (Cheek, Maxwell & Weisman, 1971; Huisman, *et al.* 2012). On the other hand, experts have unveiled bacteria and microorganisms grow faster in carpet than raw materials (Anderson, *et al.* 1982; Skoutelis, Westenfelder, Beckerdite & Phair, 1994). Moreover, organisms are found at higher concentrations in the air of carpeted than bare floors. Upholstery provides fertile conditions for bacterial growth (Noskin, *et al.* 2000). While the patient may perceive a home-like design would enhance the hospital's beauty and intimacy, they expressed concern over contaminations that might increase in the dialysis room if homey materials and accessories (carpets, wood, and textiles) were used. Considering perceptions of order and hygiene promote psychological safety in patients, furniture made from wood and fabric, despite their homey connotations, may be unsuitable for the hospital.

Lighting

Researchers found the illuminance of 1570 lx correlated with a lower medical error (2.6%) than the 480 lx baseline (3.8%). Medical error frequency contributes to patient anxiety and fear, with patient confidence in medical treatment quality mitigating these feelings (Huisman, *et al.* 2012). Although intensive lighting is not preferable for patient comfort, it may help security by increasing confidence in not experiencing a medical error.

Art

Ulrich *et al.* (2003) assessed how psychologically appropriate artwork (natural landscapes, trees, and flowers and emotionally optimistic movements and facial expressions sculptures) could relieve discomfort and foster positive outcomes for patients, like reducing pain. Dijkstra, Pieterse, and Pruyn (2008) plants in rooms alleviated patient stress, most likely because they raised beauty perceptions.

Summary and analysis of reviewed literature

Hence, applying a home-like environment in dialysis rooms may not always best meet psychological patient needs. The home-like design seems inefficient and may increase fear and anxiety in certain patients with CKF. Likewise, the institutional structure is not always the best choice for mitigating fear and anxiety in particular patients with CKF. Table 1 summarizes experts favoring home-like settings, such as single rooms and hiding the sounds and the visual presences of medical equipment to avoid the negative impacts of the institutionalized hospital. However, this strategy may not always produce the desired effects, which may exacerbate fear and anxiety. Based on Table 1, meeting psychological needs such as privacy and sociability in the interior healthcare center design remains a relative and the optimal approach depends on psychological needs.

Table (1): Literature review matrix presenting design effect on patients with CKF. **Source:** The author.

Main design feature	Design strategy	Type of the design approach	Degree of fear and anxiety mitigation	Justification	References
privacy	Single Room for patients with a serious disease	H	○	Patients suffering from serious diseases prefer shared-bed rooms.	Pease and Finlay (2002); Mogensen (2011).
	Single Room for patients without serious disease	H	●	Giving privacy, order, control, and quietness	
Sociability	Shared room for patients without serious disease	I	●	Sharing pain helps to create feelings of solidarity.	Lawson and Phiri (2003), Duel (2018); Bastian, Jetten and Ferris (2014). Ulrich, R. S. (1991).
	Shared room for patients with a serious disease	I	○	Noise and lack of privacy is a significant cause of stress.	
Psychological safety	Visual presence of medical equipment	I	●	Helps patients feeling conscious of what is going on around them.	Johansson, Bergbom, & Lindahl (2012).
	Hiding medical equipment	H	○	Reassures patients that they are being treated in a hospital with high-quality care.	
	Nurses desk observable	I	●	Enabling patients to see nursing staff moving up and down.	
Order	Standardization	I	●	Decreases staff errors. Increases staff efficiency.	Huisman, Morales, Hoof & Kort (2012) Vos, 2004, as cited in van Nijhuis, 2017
	Identical rooms				
Finishing materials and texture	Wood surfaces	H	○	Cozy, but does not meet infection prevention requirements.	Huisman, Morales, Hoof & Kort (2012); Malone & Dellinger, (2011)
	Smooth and polished surfaces	I	▣	Prevents the growth of bacteria but evokes cold feelings.	
Flooring	Carpet	H	●	Contaminates the room's air with bacteria.	Cheek, Maxwell & Weisman, (1971); Huisman, Morales, Hoof & Kort (2012); Noskin, <i>et al.</i> (2000)
	Bare or vinyl-clad floors	I	▣	Give a sense of cleaning and hospitals ambiance	
Details and accessories	Intensive lighting	I	▣	Reduces medical errors	Huisman, Morales, Hoof & Kort (2012)
	Artworks /greenery	I /H	●	Creates positive distraction.	

NOTE: ● Strong Impact, ○ No Impact, ▣ Moderate impact
● I: Institutional design approach, H: Home-like environment

Therefore, designing dialysis rooms to reduce patient anxiety and fear requires a deep understanding of the patient's psychological state and disease adaptation stage. Considering Impellicceiri (2005) and Fortune *et al.* (2002), designs should be tailored to meet the psychological needs of the following three categories of patients with CKF.

The first category entails the passengers who accept their life is fundamentally linked to the hospital and seek solace and relaxation when undergoing dialysis sessions with others. This patient category does not need to feel in control of the dialysis machine or see the machine dashboard to feel informed about what is happening. They instead prefer the caregiver observe inquiring if they choose. These patients prefer social interaction with other patients during their treatment, giving them a sense of comfort by affirming they are not alone. Passenger patients feel less fear and anxiety when surrounded by features evoking high-tech ambiance. Considering these points together, it seems the institutional design approach meets the needs of such patients well. The second category, drivers, comprises patients who want to control the dialysis machine and value privacy over sociability. Nevertheless, these patients still derive psychological safety when they perceive they are not alone and treated in a well-equipped hospital. Consistent with these competing preferences, driver patients prefer having their dialysis treatments in a shared room designed to offer some privacy from other patients. The third category, deniers, resists the idea that the hospital has become an essential part of their lives. They, therefore, prefer to undergo dialysis in a home atmosphere where medical devices remain out of sight and unheard. They also prefer remote monitoring via intelligent technology.

Results and recommendations

The experts purport how healthcare institutional design mitigates the fear and anxiety of patients with CKF. Safety, privacy, and sociability can contradict psychological needs generate a design dilemma between fulfilling psychological needs and alleviating fear and anxiety. For instance, a single room greatly facilitates privacy, creating a homely environment in healthcare centers, shared rooms enhance sociability, alleviating anxiety

and fear. Furthermore, while hiding medical devices fosters a homey ambience, they can provide patients psychological safety.

Figure 1 clarifies how healthcare design influences privacy, sociability, and psychological safety.

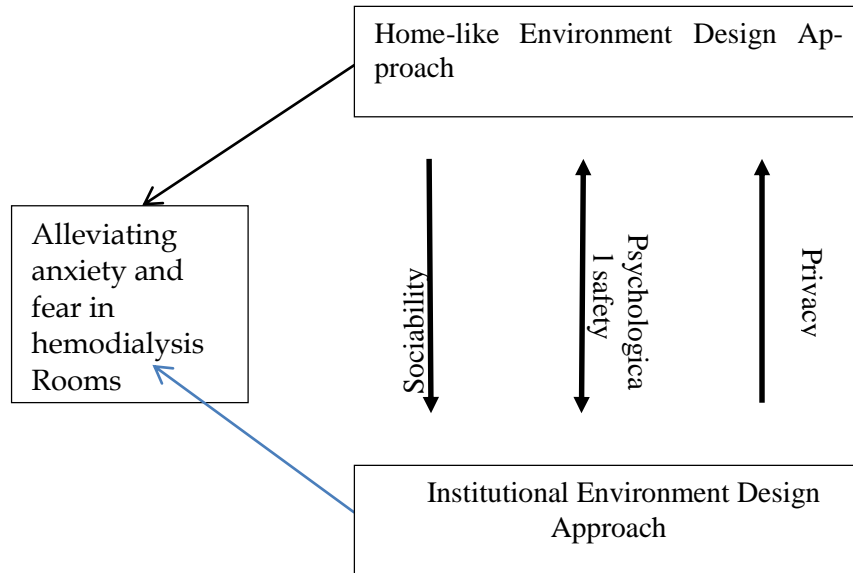


Figure (1): How Different Design Approaches Alleviate Anxiety and Fear Patients with CKF may Experience.

Source: Author

Suggested design models responding to patients with ckftypes

Based on the tripartite classification, three design models for hemodialysis rooms are recommended to meet the three patients' psychological needs.

Model 1/ passengers' Model

This model was designed to respond to the psychological needs of patients classified as passengers. It reflects the typical dialysis room structure

of existing healthcare centers, with the present research findings suggesting it meets the needs of passenger patients seeking solace and comfort by being among other patients while undergoing their dialysis treatment.



Figure (2): Institutional Dialysis Room Design Optimized for Passengers Patients.

Source: Author

Model 2/ Drivers model

This model was designed to meet the psychological needs of patients categorized as drivers. These are patients need:

- To remain and informed about their dialysis treatment.
- To find comfort and solace from undergoing dialysis treatment with other patients while valuing some privacy.

- Freedom to either interacts with other patients or quickly isolate partially from their surroundings, avoiding interaction with other patients should they prefer.

Figure 3 shows a possible design for meeting these needs. Here, dialysis chairs are arranged in parallel rows to prevent eye contact and achieve patient privacy while, at the same time, allowing each patient the option to interact with the nearby patients. This design gives patients a view of the dialysis machines and enables them to monitor their functioning. It also places them under the direct observation of nurses, offering reassurance and a sense they are actively receiving treatment. The enhanced design deliberately distinguishes it from a home environment.



Figure (3): Dialysis Room Design Optimized for Drives Patients.

Source: Author

Model 3/ Denier model

This model is designed for patients who refuse to accept their lives have become inextricably bound to the hospital and experience responding

with fear and anxiety toward the hospital environment, mainly when they see and hear operating medical devices. The setting recommended for these patients shown in Figure 4 bears the following features:

- Medical devices are hidden in alcoves, with each monitored via a nurses' station behind each patient.
- Patients are monitored via cameras and screens in the nurses' office rather than via the physical presence of nurses.
- Curtains separate beds to give patients an option of privacy while also allowing them to interact with others should they choose.
- A home-like environment uses cozy materials and colors such as wood, natural stone, and fabrics to create an intimate and homey atmosphere. These materials are placed in the upper parts of the room to reduce contamination and bacterial growth.

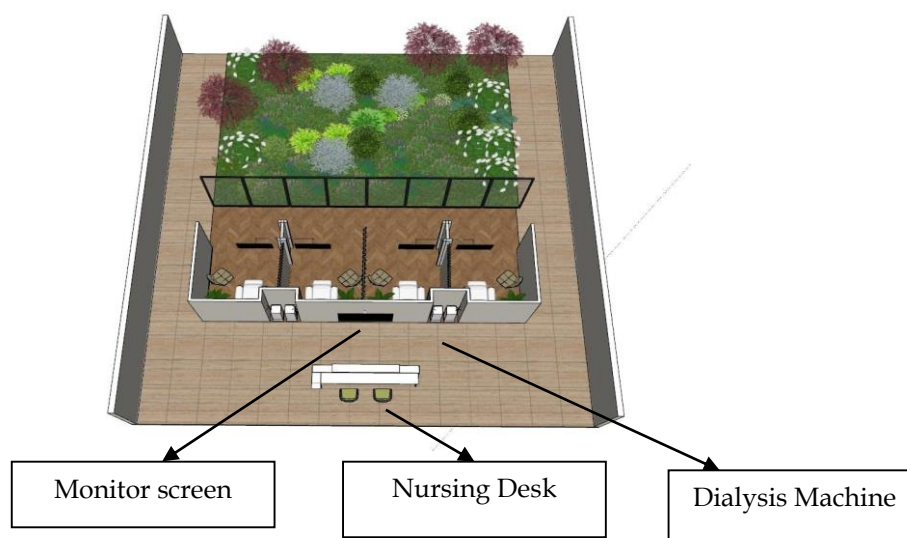


Figure- (4): Home-like dialysis room. Hiding hospitals cues and gestures from the patient view.

Source: The Author



Figure (5): Home-like dialysis room design optimized for denier patients.

Source: Author

Conclusion

The home-like design in healthcare should neither be conceived as effective nor ineffective in mitigating patients' with CKF fear and anxiety. Its effectiveness depends highly on patient personality and disease adaptation stage. Patients can be placed into three categories according to their disease acceptance and privacy preferences. Requirements for creating a sense of psychological safety differ from one category to another. The present researcher recommends an institutional design creating a high-tech ambiance and fostering a sense of psychological safety for drivers and passengers. On the other hand, he advocates a more home-like environment for patients categorized as deniers who resist accepting their disease and treatment and desire psychological safety.

Recommendations for future research

Future research might survey a large, international sample of patients with CKF to enhance finding generalizability.

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